

On being circuited through 3,500 ohms for 23 min., the E.M.F. rose to 1.383.

More observations were made than those here recorded, readings being taken in some cases every minute, but the only irregularity observed was that noticed when working through 30 ohms.

In these experiments we may notice that when the battery was short circuited through 10 ohms, the E.M.F. after the first two minutes fell  $4\frac{1}{2}$  per cent. in  $1\frac{1}{2}$  hours; through 20 ohms it fell 3 per cent.; and through 30 ohms,  $2\frac{1}{2}$  per cent., in the same time. But when circuited through 100 ohms and upwards, the E.M.F. increased with the time,\* the percentage increment increasing with the resistance. Hence it appears not unlikely that there may be some resistance through which the E.M.F. will remain absolutely constant; should this be found to be the case, and should this resistance always remain the same, the battery will be very valuable when required to work through such a circuit.

It may be remarked that, in accordance with the usual rule, the E.M.F. of the battery increases with the external resistance.

The cell was insulated for a considerable time previously to commencing each set of experiments. S. A. SAUNDER

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#### OUR BOTANICAL COLUMN

**EXOTIC TIMBER-TREES IN MAURITIUS.**—Amongst useful plants that have been introduced into countries distant from their native habitats, the timber-trees are of some interest, inasmuch as beyond the proof of their establishment in foreign climates and soils, some time is needed to prove what effects the change may have on the quality of the timber itself, for on this alone depends the value of the experiment in a commercial point of view. It is, however, satisfactory to learn that some well-known timber-trees that have been introduced into Mauritius through the instrumentality of the Royal Gardens, Kew, are in a flourishing state. Thus, the mahogany (*Swietenia mahagoni*), one of the oldest and most valued of furniture woods, has made a very rapid growth, forming, in three or four years after the sowing of the seeds, trees about twenty feet in height, with stems from three to six inches in diameter. In India, likewise, the mahogany thrives well, and as a proof that the wood is valuable, it may be stated that a tree blown down in the Calcutta Botanic Gardens during the great cyclone realised over 1,000 rupees. Logwood (*Haematoxylon campechianum*) is reported also to grow well in Mauritius, and it moreover makes excellent hedges, far superior, it is said, to hawthorn. It has been quite naturalised on the hills and waste lands in the vicinity of Port Louis, and annually produces large quantities of seeds.

**BAMBOO AS A PAPER MATERIAL.**—A good deal of attention has of late years been directed to new materials for paper making. Esparto has been one of the most successful of modern discoveries, and now we are told that the supplies of that useful substance are decreasing and must in course of time fail altogether. Where then shall we look for our future supplies is a question that has agitated many minds, and which has been answered frequently by references to the numerous fibre-producing plants of both the East and West Indies, Australia, &c. We know that in India the fibrous barks of many trees, and notably that of *Daphne papyracea*, are used for paper making; while in China and Japan, where paper is used for a much greater variety of purposes than it is in England, the barks of *Broussonetia papyrifera* and *B. Kampferi* are made into paper of every conceivable and indeed inconceivable form; for some specimens are so much like leather that it takes a critical eye to detect it, and others are such good imitations of crape and muslin that the same care is needed to determine their true nature. That the Chinese and Japanese excel in paper-making cannot be doubted, when we consider all their manufactures, and more especially that fine quality of paper known as India proof paper, which they make from young bamboos. The bamboo as a paper material in this country is a comparatively modern introduction; indeed, we can hardly say that it has actually become a commercial article, but there seems no reason why the stems of the bamboo, which in tropical countries is one of the commonest and fastest growing plants, should not be con-

\* As the coils were arranged in boxes, and so could not be kept at a uniform temperature, it was thought that this might be due to unequal heating. It was found, however, that the alteration in the ratio of the resistances due to this cause was such as to cause the E.M.F. to appear to increase less than it really did by about  $1\frac{1}{2}$  per cent. in one hour, which would not affect the results in the tables.

verted into *half stuff* and sent to England in almost any quantity. To make this material better known has been the aim of Mr. Thos. Routledge, in a little pamphlet of forty pages, which he has just issued. Mr. Routledge is no doubt able to speak with authority on the details of manipulation of paper stock in a practical, if not in a scientific sense; but it is not our intention to follow him through the subject, but simply to refer to some facts quoted by him as an illustration of the suitability of bamboo as a paper-making material, and to endorse to a certain extent some of those facts and suggestions. Thus, with regard to supply, it is well known that in most tropical countries bamboos of various species flourish to a considerable extent and are to the people of immense value, furnishing them with numerous articles of daily necessity; then again their growth is so rapid as to form a constant supply. With regard to the rate of growth, we read that at Gehzireh, the gardens of the Khedive of Egypt at Cairo, it has been known to grow nine inches in one night. At Sion House, the Duke of Northumberland's, stems of *Bambusa gigantea* have attained the height of 60 feet in twelve weeks; while at Kew, *Bambusa vulgaris* is recorded as growing in favourable seasons at the rate of eighteen inches per day; and at Chatsworth the same species has attained the height of 40 feet in forty days. For the purpose of paper-making the stems should be cut down in a comparatively young state, before they become too woody, and reduced to pulp or half stuff before being sent to this country.

#### SCIENTIFIC SERIALS

*American Journal of Science and Arts*, October.—This number contains the following two papers read at the Detroit meeting of the American Association for the Advancement of Science.—Address of Dr. John Le Conte, the retiring president.—A comparison between the Ohio and West Virginia sides of the Alleghany coal-field, by E. B. Andrews.—There is also a reprint from the *Philosophical Magazine* of Mr. Mallet's paper on the temperature attainable by rock-crushing.—In an obituary notice of Sir Charles Lyell, there is introduced an extract of a letter from Dr. Mantell to Prof. Silliman, in 1841, describing how Mantell and Lyell first met.—The original articles in this number are: On the arithmetical relations between the atomic weights, by M. D. C. Hodges.—A note by L. F. Pourtales recording the corals found at the Galapagos Islands.—On instinct (?) in hermit crabs, by Alexander Agassiz. This records how young crabs reared without shells during their growth, "made a rush" for them as soon as they were placed in the tank where they were living.—On Southern New England during the melting of the great glacier, Part ii. We reserve our notice of this till the paper is completed.

*Geological Magazine*, October.—The original articles are: The Geology of Central Sumatra, by R. D. M. Verbeek (superintendent of the Geological Survey of Sumatra). This is stated to be the commencement of a series of articles on the subject, published with the authority and assistance of the Dutch-Indian Government. The oldest rocks in this part of Sumatra are granites, granite-syenites, and syenites. Then follow sedimentary rocks classed as of Carboniferous or Permian age. "This oldest sedimentary formation of Sumatra can be divided into two parts. The lower portion consists of clay-slates with auriferous quartz-veins, marl-slates and siliceous schists; the upper part consists only of limestone, with some small beds of schists." There are quartz porphyries and greenstones, the age of which is not known, but they are probably older than the tertiaries. The tertiaries themselves are divisible into five groups. The trachytic rocks are younger than the tertiaries. Three clearly drawn sections illustrate the paper, and a list of principal papers on the geology of Sumatra is given.—On the origin of Coums, by J. G. Goodchild. That many of these cauldron-like hollows are due to the eddying of ice is the argument of Mr. Goodchild.—Dr. Walter Flights continues his "History of Meteorites."—Dr. Thomas Wright records the occurrence of the genus *Cotylederma* in the middle lias of Dorsetshire.

*Poggendorff's Annalen*, No. 8.—This number commences with an investigation by Karl Müller as to the pitch of the transversal vibrations of bars of gypsum, when these are saturated with different droppable liquids. It appears that the liquid does not act as a weighting of the bar, but enters into union with the molecules of the substance, diminishing the co-efficient of elasticity; and this is manifested in a fall of pitch, the fall having

been greatest (in the cases studied) on imbibition with water, less with oil, and least with alcohol. It is greater the higher the specific gravity of the liquid. The change of pitch with alcohol and with oil was more regular than with water, and the regularity was almost perfect, if the changes of tone of the saturated bars were compared with one another, and not with the dry state.—Herren Kundt and Warburg continue the account of their researches on friction and conduction of heat in rarefied gases. Having experimented with air, hydrogen, and carbonic acid, they here show that the coefficients of friction are independent of pressure within the limits 750 mm. and 1 mm. mercury. With rarefaction under 1 mm. they could not sufficiently remove the vapour.—Dr. Oberbeck describes a method of determining the conductivity of liquids for electricity. The principle is briefly this:—Connect the ends of an induction spiral with a spark micrometer. Then, with a certain strength of inducing current, a separation of the balls may be found, at which sparks continuously pass; but on slightly increasing the interval they cease to pass. Next, connect the two ends of the spiral also with an uninterrupted branch line; it will depend on the resistance of this and the intensity of the inducing current, whether sparks will pass between the balls. If the line is short and of metallic wire, the spark current disappears, however near together the balls may be brought; but if it consist of thin tubes of badly conducting liquids, a small approximation of the balls will reproduce the sparks. Thus the conductivity of liquids may be compared.—An improved construction of lightning conductors for telegraph-wires is described by M. Schaack. The line-wire and that of the telegraph-apparatus are connected respectively with two binding screws on pieces of wood which form opposite rims of a rectangular tin case containing water, and a loose coil of German silver wire, covered with caoutchouc, connects the binding screws through the water. The wire of the telegraph-apparatus, after passing through the apparatus, returns to the case, which is connected to earth.—There is also an account of M. Le Cour's valuable proposal for employment of tuning-forks in electric telegraphy.—M. Schneebeli continues his researches on the attraction and separation-time of electro-magnets, and takes occasion to describe Hipp's chronograph as recently improved.—Among the remaining papers may be noted one by M. Sauer, describing some interesting experiments on the visibility of ultra-violet rays, and another by M. Holz, on transformation of electric currents of low tension into disruptive discharges of higher tension.

*Der Naturforscher*, September.—This number contains some interesting observations made at hot springs in Italy, by M. Hoppe Seyler, on the upper temperature-limit of life. At Ischia, on Monte Tabor, he found green algae on the widening sides of a fissure through which rose hot steam, and the thermometer showed  $64^{\circ}7$  C. This was higher than in the case of algae growing in water; at Lipari, the limit of temperature for such seemed to be about  $53^{\circ}$ .—In a lecture by M. Brefeld (given in outline), on the biology of yeast cells, the author describes the process of fructification, which is asexual, and tells how all his attempts to produce it with cultivated yeast were in vain; with the natural yeast used in fermenting wine he always succeeded.—The peculiar condition of vegetation on the sides of lakes, and banks of rivers, owing to reflection of light and heat from the water, and constancy of temperature of the latter, is illustrated by Dr. Hoffmann from a number of phænological phenomena on Lake Maggiore, the lakes of Geneva, Zurich, and other localities.—M. Felix Plateau investigates the process of digestion in insects; and M. Böhm records the gases resulting from fermentation of dead marsh and water plants; finding that these gases sometimes consist of carbonic acid, nitrogen, and hydrogen, sometimes of marsh gas with the first two. There is, he thinks, a sort of conflict between the two fermenting processes.—From accounts of the aurora of Feb. 4, 1872, Donati is led to the striking result that it was observed in different regions of the earth not in the same physical moment, but everywhere at the same local hour; as is the case with celestial phenomena which do not share in the earth's rotation. The aurora appeared first in the extreme east of the southern hemisphere, in Eden and Melbourne, and shortly after in China, whence it travelled over Asia, Europe, and America. Donati attributes the phenomenon to electro-magnetic currents from the sun.—There is also a paper on the movements of Encke's comet, by Dr. von Asten; and among other subjects treated are: insular giant reptiles, diathermancy of moist air, beats of musical tones, and the formation of meteorites and vulcanism.

*Zeitschrift der Oesterreichische Gesellschaft für Meteorologie*, Sept. 15.—The first paper in this number, by Herr Luedicke, of Gotha, gives an account of observations made by him on the tidal action of the moon in its several phases on the atmosphere, during a period of 100 revolutions, from Jan. 1867 to Feb. 1875. The differences between the mean heights of the barometer in the four quarters are small; the greatest difference, viz., that between the second and last quarter, amounting only to '57 mm. The various tables given by Herr Luedicke agree, however, in pointing to the following conclusion:—That pressure diminishes with the waxing and increases with the waning moon. Comparing the means of readings nearest perigee with those nearest apogee, he finds (1) that pressure is less at perigee than at apogee; and (2) that pressure in apogee is less about the time of the equinoxes, greater about the time of the solstices, than in perigee. Lastly, taking the mean variations from the monthly mean of all observations taken in apogee and in perigee, that in perigee the excesses happen at the quadratures, the deficiencies at the syzygies; and inversely, in apogee the excesses happen at the syzygies and the deficiencies at the quadratures. These variations are rather large: for instance, in apogee at the first quarter the deficiency is  $3^{\circ}83$ , at the last  $5^{\circ}16$  mm. It appears from all his results that the effect of the moon upon the atmosphere is exactly contrary to that produced upon the ocean, pressure being lower when the moon is near than when it is far from the earth. Tables of the varieties of weather in the four quarters are given at the end of the paper.—In the "Kleinere Mittheilungen" two articles appear on Mr. Blanford's observations in India.

*Bulletin de l'Académie Royale des Sciences de Belgique*, tom. xl. No. 7.—In the "Classe des Science" are the following articles:—A brief note by M. Emm. Liais, on the parallax of the sun.—A note on *Drosera rotundifolia*, by M. Ed. Morren, to which is a plate showing the structure of the different kinds of glands and hairs. M. Morren describes the capture of two insects, and especially draws attention to the way in which the glands curve in "prehension," like an animal's tongue.—M. G. Dewalque contributes a short article on lightning strokes.—M. E. Quetelet records the dip of the needle at Brussels in 1875, determined on two dates—

April 14, between 10.30 A.M. and 12.30 =  $66^{\circ} 56'6$   
May 22 " 11 " 12 =  $66^{\circ} 58'8$

The diminution is at the rate of  $2\frac{1}{4}$  min. per annum. The declination has been determined on three days as follows:—

June 9, between 11 A.M. and 12.30 =  $17^{\circ} 24'4$   
" 23 " 10.30 " 11.30 =  $17^{\circ} 25'1$   
" " 2 " 3 =  $17^{\circ} 26'3$

The decrease is  $8\frac{1}{4}$  min. per annum. This last observation was by M. Hooreman.—M. L. Saltel contributes two mathematical papers.

*THE Journal de Physique* for September commences with a paper by M. Marey on the movements of liquid waves in elastic tubes, a phenomenon exemplified in the circulation of the blood. He applies his graphic method: passing an indiarubber tube through a series of boxes in such a way that when it expands at successive points, through passage of a wave, it presses upwards the membrane of one of the well-known monometric capsules. These successive movements are indicated, as usual, on a rotating blackened cylinder. He explains the various phenomena of positive, negative, secondary, and reflected waves, harmonic vibrations, &c.—M. Govi follows with an account of some experiments meant to prove that induced electricity of the first kind has tension. A new instrument for determining, more especially, the density of solids of which only small fragments are had, is described by M. Paquet. It is like a Baumé ariometer, consisting of a pear-shaped air-vessel, weighted at the lower, narrow end with a bulb of mercury, while a thin tube rises from the upper part, surmounted by a short wider tube closed below, into which the solid fragment is put, with water. Both tubes are graduated. The density is ascertained after immersion of the instrument in water.—A valuable paper by M. de Romilly treats of the conveyance of air by a jet of air or steam, issuing from one ajutage, and entering another; several varieties of ajutage having been experimented with, and in different positions. He finds, *inter alia*, there is an integral conservation of the quantity of motion, with a conical receiver of 5 to 7 degrees, small section towards the jet-ajutage, which is placed at an exterior distance, given by the form of the jet, making a cone of about 15 degrees, the jet-orifice occupying the summit, and the receiver-orifice the base.

—M. Righi contributes a paper on an electroscope with very sensitive dry piles ; its use in some experiments on electricity of contact, and on the electromotive force of heat. The journal concludes with a number of abstracts from other serials.

*Bulletin de la Société d'Anthropologie de Paris*, 1875.—In fascicule 4<sup>me</sup>, tome ix. 1<sup>re</sup> série, M. G. de Rialle, in considering the present state of our knowledge in regard to the races inhabiting Central Asia, invites travellers to turn their attention to the study of the Herazehs, who occupy the most easterly spurs of the chain of the Paropamisus, and who still preserve many traces of the habits and traditions of the northern steppes, from which they have probably been driven by Mongol invaders. Little is known of these people, who are dreaded by the Afghans for their bravery and ferocity, and who regard themselves as allied to the Calmuks of Cabul. In the course of the discussion on M. de Rialle's paper, Madame C. Royer drew attention to the important service which travellers might render to the sciences of Comparative Ethnology and Anthropology, if they would make young children, in whom distinctions of race are most prominently exhibited, the special objects of their observations. M. Topinard, in conclusion, called upon the members of the Central Asiatic Expedition to discover whether any survivors could still be traced of the fair-skinned people described by the Chinese as inhabiting the western portion of the central plain of Asia two or three centuries before our era, and as having green eyes and red hair. Tchihatcheff asserts that he has met with red-haired individuals among the nomad Turkomans of Asia Minor, and Desmoulin believes that they are typical representatives of the primitive Turks.—In the same number of the *Bulletin* we have a summary of the views entertained by M. A. de Bertrand and others in regard to the definition and classification of prehistoric eras. M. de Bertrand, in considering the age of the Reindeer of Thurigen, suggests that we may refer the period of the introduction of polished stone into Gaul to about 3,400 years before the Christian era, and that we may possibly assume 2,000 years as the maximum of the duration of this age. His attempted determination of these periods was strongly opposed by MM. Leguay, Roujon, and others.—Several interesting reports have been laid before the Paris Society, of the numerous caves and grottoes which have been examined in the course of 1874, by M. Louis Lartet, Lagarde, and other members. The finds at Cumières, near Verdun, have been especially rich, while the explorations made at the cemetery of Curanda (Aisne) are valuable from the great variety of objects intermingled with the human remains, but owing to the successive occupation of the ground by Gallic, Romano-Gallic, and later populations, the results yield no certain evidence of the antiquity of the earlier races, whose remains are interspersed among those of definite and determinable historical character. An examination of the remains *in situ* has, however, led M. Millescamps to the important conclusion that flint instruments were cut and used as recently as the Merovingian age in France.—M. P. Broca has proposed to adopt the word "Stéréométrie" for that branch of craniometric science which treats of the determination of cranial capacities. In his paper M. Broca explains the various methods which he has found best adapted for the purpose. He considers that, of all the substances tried, bullet-lead, although not perfectly free from sources of error, is the most reliable, the results yielded by repeated experiments varying not more than five cubic centimetres for the same skull. No absolutely correct method has as yet been devised, and hence we must content ourselves for the present with approximate results.

*Sitzungsberichte der Kgl. böhm. Ges. der Wissenschaften in Prag*.—The publication of this Society comprises the whole of 1874, during which period some thirty important papers were read in the Natural Science Department of the Society. We notice the following:—On the independent representation of the  $n$ th derivative of broken functions of a variable, by Prof. Dr. Studnicka.—On the chemical composition of microsomite, by Prof. Safarik.—On harmonic systems of points on rational curves of the third and fourth order, by K. Zahradník.—On the discovery of diluvial animal remains in the Elbe Loess, near Aussig, by Dr. Laube.—On some minerals from Kuchelbad, near Prague, by Dr. Safarik.—On the different forms and the significance of the changes in generation of plants, by Dr. L. Celakovský.—Researches on the hydrotopy of Bohemia, by Dr. Studnicka.—On the inflorescences of Boragineæ, by Dr. L. Celakovský.—The solution of the problem of seat and essence of attraction, by Dr. Studnicka.—On the laws regulating

incandescence of wires by electric currents, by Prof. A. von Waltenhofen.—Contradiction of Stieda's criticism on the author's work "On Hair," by Dr. J. Schöbl.—On a hyæna skull, by Dr. A. Fric.—On the Myriopoda hitherto observed in Bohemia, by Prof. F. V. Rosicky.—On a new universal microscope, by Prof. Zenger.—On a new photographic process to enlarge photographs correctly and to any size, by the same.—On curves of the fourth order, by Prof. E. Weyr.—On the travels of M. Emil Holub in Southern Africa, by Prof. C. Koristka.—On a new mineral mixture, named Parankerite, by Dr. Boricky.—On the theory of Cardioids, by Dr. K. Zahradník.—On the discovery of an Ichthyomorphous *Ceratodus Barrandei* in the gas coal of the Rakonitz deposit, by Dr. A. Fric.—On the elements of a mechanical theory of ocean currents, by Prof. G. Blazek.—On the Cladocera-fauna of Bohemia, by B. Hellrich. Preliminary researches on the Annelida of Bohemia hitherto observed, by F. Vejdovsky.—On the integration of differential equations of the first order, by Dr. E. Weyr.—On the pseudoscorpion-fauna of Bohemia, by Prof. A. Stecker.—On the coal deposit of Pilsen, by Prof. J. Krejci.—Report on the chalk deposits of Perutz, in Bohemia, and their fossil remains, by the same.—On a new simple method of determining tautozonal planes of crystals, by the same.

The August number of the *Bulletin de la Société d'Acclimatation de Paris* contains a very instructive paper, by Dr. Vidal, on the fauna and flora of Japan. The useful indigenous animals of that country are not so numerous as the geographical position of the islands would seem to indicate ; the principal are a small species of ox, goats, rabbits, and wild boars. Imported animals, such as sheep and pigs, are rare, the former, indeed, not appearing to thrive in the climate, although they exist in considerable quantities on the opposite coasts of Northern China. A species of small black bear, and monkeys, are prized by the natives as articles of diet. Horses are abundant, though the ass and the mule are unknown in the country. Birds, both useful and ornamental, are very numerous, the principal being several varieties of duck and common "barndoor fowls," pheasants, and quails ; wild geese are abundant, but the domestic variety and the turkey are almost unknown. Of fish there is a plentiful supply, and the fisheries form one of the most important industries of the country. Salmon are very common and highly prized.—M. L. Faton gives a summary of experiments with several kinds of vegetables and useful and ornamental plants, which is valuable as indicating the species which best repay the trouble of scientific cultivation.—At the July meeting of the Society a letter was read from M. C. Naudin, enclosing seeds of *Cytisus proliferus* from the Canary Islands, a plant which is cultivated there for the sake of its leaves, which are used as food for cattle. M. Naudin suggests that it might be usefully cultivated in France, or at any rate at the Cape of Good Hope, and in Australia.—Another plant (*Keana luxurians*), called in Guatemala Téosinté, and cultivated there for the same purposes as the one above named, is recommended by M. J. Rossignon.

*Reale Istituto Lombardo di Scienze e Lettere*. Rendiconti, vol. viii, fasc. xvi. The first portion of this number contains the following among other papers :—On the hydrological map of the department of Senna e Marne, by M. Curioni.—On two benzobisulphuric acids and their relations to other compounds, by MM. Koerner and Monselise.—The second portion of these Rendiconti contains reports by M. Carcano and M. Hajech, on the work of the Institute during the year ; accounts of prize awards, with reports of committees on the competitive memoirs ; and an announcement of prizes to be competed for within the next three years. Among the subjects of the latter we note the following :—Actual mean longevity of man in Italy, compared with other peoples ; What are the best antifermentatives and antisepsics, disinfectants and deodorizers ? Indicate a good method of cremation ; Respective merits of animal and human vaccination ; Embryogeny of silkworm ; History of the progress of the anatomy and physiology of the brain, in the present century.

#### SOCIETIES AND ACADEMIES MANCHESTER

Scientific Students' Association, Oct. 20.—Mr. John Plant, F.G.S., in the chair.—Mr. Wm. Gee lectured on *Polytrichum commune* (the common Hair-moss), as a type of moss-structure, commenting on the points of differentiation between true mosses and cryptogams erroneously associated with them, tracing the life-cycle, the minute anatomy of the organs, and the